National Institute of Environmental Health Sciences

Modeling the potential distribution of Bacillus anthracis under multiple climate change scenarios for Kazakhstan

Author(s): Joyner TA, Lukhnova L, Pazilov Y, Temiralyeva G, Hugh-Jones ME, Aikimbayev A, Blackburn JK

Year: 2010
Journal: PLoS One. 5 (3): e9596

Abstract:

Anthrax, caused by the bacterium Bacillus anthracis, is a zoonotic disease that persists throughout much of the world in livestock, wildlife, and secondarily infects humans. This is true across much of Central Asia, and particularly the Steppe region, including Kazakhstan. This study employed the Genetic Algorithm for Rule-set Prediction (GARP) to model the current and future geographic distribution of Bacillus anthracis in Kazakhstan based on the A2 and B2 IPCC SRES climate change scenarios using a 5-variable data set at 55 km(2) and 8 km(2) and a 6-variable BioClim data set at 8 km(2). Future models suggest large areas predicted under current conditions may be reduced by 2050 with the A2 model predicting approximately 14-16% loss across the three spatial resolutions. There was greater variability in the B2 models across scenarios predicting approximately 15% loss at 55 km(2), approximately 34% loss at 8 km(2), and approximately 30% loss with the BioClim variables. Only very small areas of habitat expansion into new areas were predicted by either A2 or B2 in any models. Greater areas of habitat loss are predicted in the southern regions of Kazakhstan by A2 and B2 models, while moderate habitat loss is also predicted in the northern regions by either B2 model at 8 km(2). Anthrax disease control relies mainly on livestock vaccination and proper carcass disposal, both of which require adequate surveillance. In many situations, including that of Kazakhstan, vaccine resources are limited, and understanding the geographic distribution of the organism, in tandem with current data on livestock population dynamics, can aid in properly allocating doses. While speculative, contemplating future changes in livestock distributions and B. anthracis spore promoting environments can be useful for establishing future surveillance priorities. This study may also have broader applications to global public health surveillance relating to other diseases in addition to B. anthracis.

Source: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2834750

Resource Description

Climate Scenario :

specification of climate scenario (set of assumptions about future states related to climate)

Special Report on Emissions Scenarios (SRES)

Special Report on Emissions Scenarios (SRES) Scenario: SRES A2, SRES B2

Exposure :

weather or climate related pathway by which climate change affects health

Ecosystem Changes, Food/Water Quality, Precipitation, Temperature

Food/Water Quality: Pathogen

Temperature: Fluctuations

Geographic Feature: ☒

resource focuses on specific type of geography

Rural

Geographic Location: ☒

resource focuses on specific location

Non-United States

Non-United States: Asia

Asian Region/Country: Other Asian Country

Other Asian Country: Kazakhstan

Health Impact: ☒

specification of health effect or disease related to climate change exposure

Infectious Disease

Infectious Disease: Zoonotic Disease

Zoonotic Disease: Anthrax

Mitigation/Adaptation: ☒

mitigation or adaptation strategy is a focus of resource

Adaptation

Model/Methodology: ☒

type of model used or methodology development is a focus of resource

Exposure Change Prediction

Resource Type: ☒

format or standard characteristic of resource

Research Article

Timescale: ☒

time period studied

Medium-Term (10-50 years)

Vulnerability/Impact Assessment: ☒

resource focus on process of identifying, quantifying, and prioritizing vulnerabilities in a system

A focus of content